VERTICAL DISTRIBUTION AND ABUNDANCE OF PSEUDOSCORPIONS (ARACHNIDA) IN THE SOIL OF TWO DIFFERENT NEOTROPICAL PRIMARY FORESTS DURING THE DRY AND RAINY SEASONS

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Pseudoscorpions were extracted from 0-14cm soil depth in two dryland (upland) forests near Manaus, Brazil. In a primary forest on yellow latosol, about 1700 specimens per m^2 were obtained during the dry season and 1135 during the rainy season. They accounted for 10-15% of all arthropods extracted, excluding Acari and Collembola. In a primary forest on white sand soil (campinarana), about 530 specimens per m^2 were obtained during the dry season and 480 during the rainy season. They accounted for only 3-4% of all arthropods extracted, again excluding Acari and Collembola. Significant but different correlations were found in both forest types between the abundance of pseudoscorpions and changing moisture, temperature and pH conditions in relation to soil depth and season. Neither during the dry season nor during the rainy season was the abundance of pseudoscorpions in mineral subsoils higher in response to the changing soil moisture content in organic layers. This was reported for arthropods from forests in the seasonal tropics where periods without precipitation occur. Results are discussed at the species level. They are compared with published data on the vertical distribution and abundance of pseudoscorpion species from the yellow latosol of a secondary dryland forest (dry season and rainy season) from the same region.
In zwei Festlandwäldern in der Umgebung von Manaus wurden Pseudoskorpione aus 0-14cm Bodentiefe extrahiert. In einem Primärwald auf gelbem Latosolboden wurden während der Trockenzeit 1700 und während der Regenzeit 1135 Individuen pro m^2 nachgewiesen. Sie repräsentierten 10-15% aller extrahierten Arthropoden, Acari und Collembola ausgenommen. In einem Primärwald auf Weißsandboden (campinarana) wurden während der Trockenzeit 530 und während der Regenzeit 480 Individuen pro m^2 nachgewiesen. Sie repräsentierten nur 3-4% aller extrahierten Arthropoden, Acari und Collembolen wiederum ausgenommen. Signifikante aber unterschiedliche Korrelationen ergaben sich in beiden Waldtypen zwischen der Abundanz der Pseudoskorpione und der sich ändernden Feuchte, der Temperatur und dem pH in Bezug auf Bodentiefe und Jahreszeit. Weder während der Trockenzeit, noch während der Regenzeit, war die Abundanz der Pseudoskorpione im mineralischen Unterboden als Folge auf die sich ändernde Feuchte im organischen Oberboden höher. Dies wurde für Arthropoden in Wäldern der saisonalen Tropen, die Trockenperioden durchlaufen, nachgewiesen. Die Ergebnisse werden auf Artniveau diskutiert. Sie werden mit publizierten Daten über die Vertikalverteilung und Abundanz von Pseudoskorpionarten aus einem Sekundärwald auf gelbem Latosolboden im gleichen Gebiet verglichen. □*Pseudoscorpiones, abundance, seasonality, vertical distribution, Neotropics.*

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In those wet but markedly seasonal tropics where periods without precipitation occur, terrestrial arthropods are reported to migrate to mineral subsoils in the dry season as a response to changing humidity in organic layers (Beck, 1964; Bullock, 1967; Goffinet, 1976; Lawrence, 1953; Levings and Windsor, 1984; Liebermann and Dock, 1982; Merino and Serafino, 1978; Petersen and Luxton, 1982; Rybalov, 1990; Strickland, 1947; Willis, 1976 and others). Central Amazonian dryland (= non-flooded upland) forests experience a rainy season (December-May; average monthly rainfall 211-300mm) and a 'dry' (= drier) season (June November; average monthly rainfall 42-162mm). Annual precipitation is 2105mm (based on 75 years of records from the meteorological station at Manaus, cf. Ribeiro and Adis, 1984). About 75% of the rainfall (1500mm) is recorded during the rainy season. This had no observable difference in vertical distribution of terrestrial arthropods in primary forests on yellow latosol

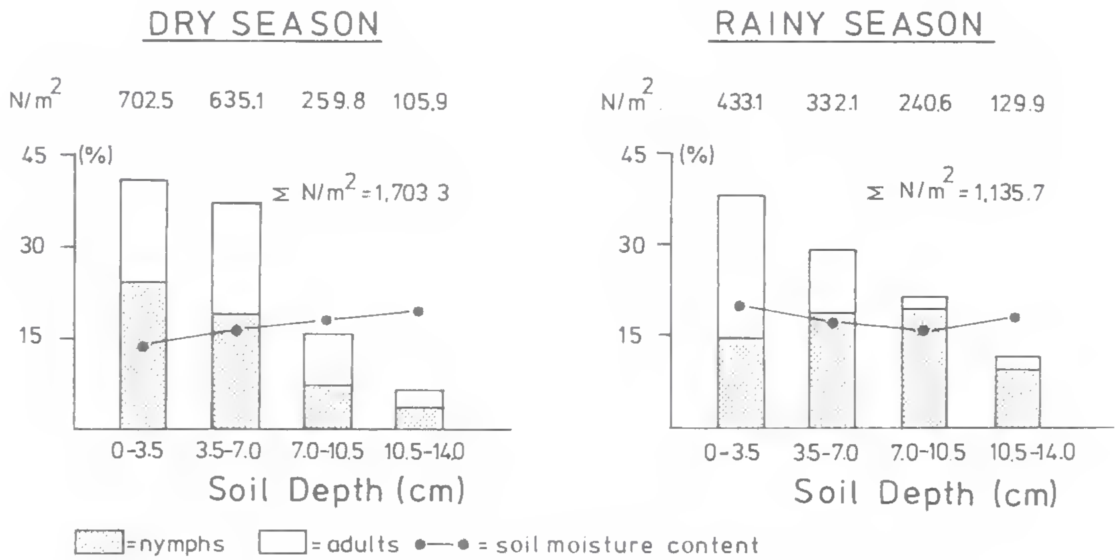

FIG. 1. Distribution of pseudoscorpions in soil and soil moisture content (both in %). Samples taken every 3.5cm to depth of 14cm in dry season and in rainy season in primary dryland forest on yellow latosol near Manaus, Brazil. Total catch each season = 100%. Abundance for each soil layer (N/m^2) and for total catch/ season (ΣN/m^2).

and on white sand soil (Adis *et al.*, 1989a, b, unpublished data; Morais, 1985). However, results were based mainly on data for orders. Evaluation of sampling data at the species level is now possible for pseudoscorpions, since identification has been completed by the second author.

STUDY AREAS

PRIMARY FOREST ON YELLOW LATOSOL

Sampling was carried out during the rainy (March) and dry seasons (October) of 1987 in a dryland terra firme forest at the Ducke Forest Reserve (= Reserva Florestal A. Ducke, 2°55'S, 59°59'W) of the National Institute for Amazonian Research (INPA, Manaus), situated on the Manaus-Itacoatiara highway (AM-010; cf. Penny and Arias, 1982). The area sampled was classified as high terra firme forest (Takeuchi, 1961; cf. Brinkmann, 1971) with several species of large, broad-trunked trees (with or without buttresses). The trees reached 44m in height (average height: 22m) and formed a closed canopy. Approximately 235 species, representing 43 families of trees, were recorded in the study area. Most frequent were Leguminosae, Rosaceae, Lauraceae, Sapotaceae and Lecitidaceae. The forest had a patchy understorey and a scanty herb layer. Guillaumet (1987), Lechthaler (1956), Prance (1990), Prance *et al.* (1976) and Rodrigues (1967) provide detailed botanical descriptions of the forest. Microclimatic data are given by Decico *et al.* (1977), Marques *et al.* (1981) and Ribeiro and Nova (1979). The soils near the Ducke Forest Reserve were described by Falesi and Silva (1969) as deep, yellow latosols, strongly weathered, excessively to very strongly acidic, of heavy texture in all profiles (A-C: 0-110cm) and with clay content of the B horizon varying from 50-70%. In the study area, where entomological long-term investigations have previously been undertaken (Adis and Schubart, 1984; Morais, 1985; Penny and Arias, 1982), the soil carried a 1-3cm thick humus layer (A_o), interspersed with fine roots and a thin leaf litter, covering most of the surface. For further details on the study area see Penny and Arias, 1982.

During the 1987 rainy season, 322mm of rain were recorded in March (data from the meteorological station at Ducke Forest Reserve, provided by M. de N.G. Ribeiro at INPA, Manaus). On the day of sampling (March 20, 1987) soil moisture content (= weight difference between wet and dried soil samples in%) was 20.0% at 0-3.5cm (= humus layer), 17.5% at 3.5-7cm, 15.5% at 7-10.5cm and 17.7% at 10.5-14cm soil depth, respectively (= mineral subsoil) (Fig. 1). Soil temperature at 10 a.m. decreased from 25.2°C in the top 3.5cm to 24.5°C at a soil

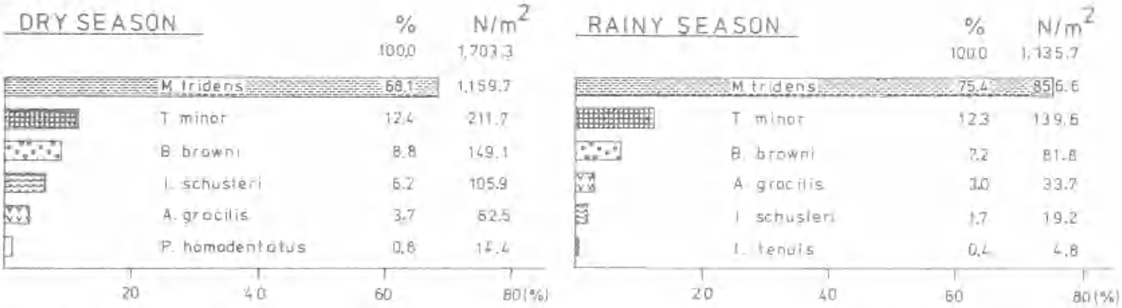

FIG. 2. Dominance (%)and abundance (N/m^2) of species of pseudoscorpions extracted from 1m^2 of soil (0-14cm depth) during dry season (October 1987) and rainy season (March 1987) in primary dryland forest on yellow latosol near Manaus, Brazil. Total catch of each season = 100%. (See text for further explanation).

depth of 14cm. The soil pH increased from 3.3 in the top 3.5cm to 3.8 in the lower layers (3.5.-14cm). During the 1987 dry season, 139mm of rain were recorded in October (data from the meteorological station at Ducke Forest Reserve). On the day of sampling (October 14, 1987) soil moisture content increased from 13.6% in the top 3.5cm to 19.1% at a soil depth of 14cm (Fig. 1) and the soil pH increased from 3.3 to 3.8. Soil temperature at 11 a.m. varied slightly (24.6-24.7°C) from the surface to 14cm.

Primary Forest on White Sand Soil

Sampling was carried out during the rainy season (March) and the dry season (August) of 1988 in a dryland campinarana forest of the Biological Reserve INPA/SUFRAMA (approx. 2°30'S, 60°10'W), at km 45 (formerly km 62) on the Manaus Boa Vista highway (BR -174). Campinarana (= caatinga arbórea) was classified as a low, relatively light forest on white sand soil with thin-stemmed trees 10-20m high, with occasional large, broad-trunked individuals, with or without buttresses, a patchy understorey and no herb layer (Guillaumet, 1987; Anderson, 1981; Lisbõa, 1975). Data on geomorphology and soil genesis are found in Chauvel *et al.* (1987). Floral inventories have been given by Lisbõa (1975), Braga (1979), Anderson *et al.* (1975), Anderson (1981) and Guillaumet (1987), while the microclimatic data were provided by Ribeiro and Santos (1975). In the study area, the white sand soil carried a humus layer that was 10-11cm thick (A_o), penetrated by a matting of roots and a thin, surface-covering leaf litter.

During the 1988 rainy season, 293mm of rain were recorded in February and 280mm in March (data from the meteorological station of EMBRAPA/UEPAE, km 54). On the day of sampling (March 18, 1988) soil moisture content (= weight difference between wet and dried soil samples in %) increased from 20.1% in the top 3.5cm to 26.2% at 10.5cm depth (= humus layer) and dropped to 9.9% at 10.5-14cm (= white sand soil) (Fig. 4). Soil temperature at 11 a.m. decreased from 24.7°C in the top 3.5cm to 24.5°C at a soil depth of 14cm. The pH of the soil was 3.2 (0-3.5cm), 3.3 (3.5-7cm), 3.6 (7-10.5cm) and 3.7 (10.5-14cm), respectively. During the 1988 dry season, 77mm of rainfall were recorded in August (data from the meteorological station of EMBRAPA/UEPAE, km 54). On the day of sampling (August 05, 1988) soil moisture content decreased from 21.9% in the top 3.5cm to 9.5% at 10.5cm depth (= humus layer) and to 9.3% at 10.5-14cm (= white sand soil; Fig. 4). Soil temperature at 3 p.m. decreased from 27.1°C in the top 3.5cm to 25.5°C at a soil depth of 14cm. The pH of the soil was 3.6 (0-3.5cm), 3.5 (3.5-7cm), 3.5 (7-10.5cm) and 3.6 (10.5-14cm), respectively. The relative light intensity on the forest floor was about 2.1% (210 lx; comparative value in the open air at 3 p.m., 10.000 lx (overcast sky); cf. Brinkmann, 1970, 1971).

METHODOLOGY

In both study areas, six soil samples were taken along a transect at random intervals with a split corer (a steel cylinder with lateral hinges; diameter 21cm, length 33cm) which was driven into the soil with a mallet. Each sample was taken to a depth of 14cm and was then divided into four subsamples of 3.5cm each. Animals were extracted from subsamples following a modified method of Kempson (Adis, 1987). All pseudoscorpions were separated by species [adults (males and females), nymphal instars] and their

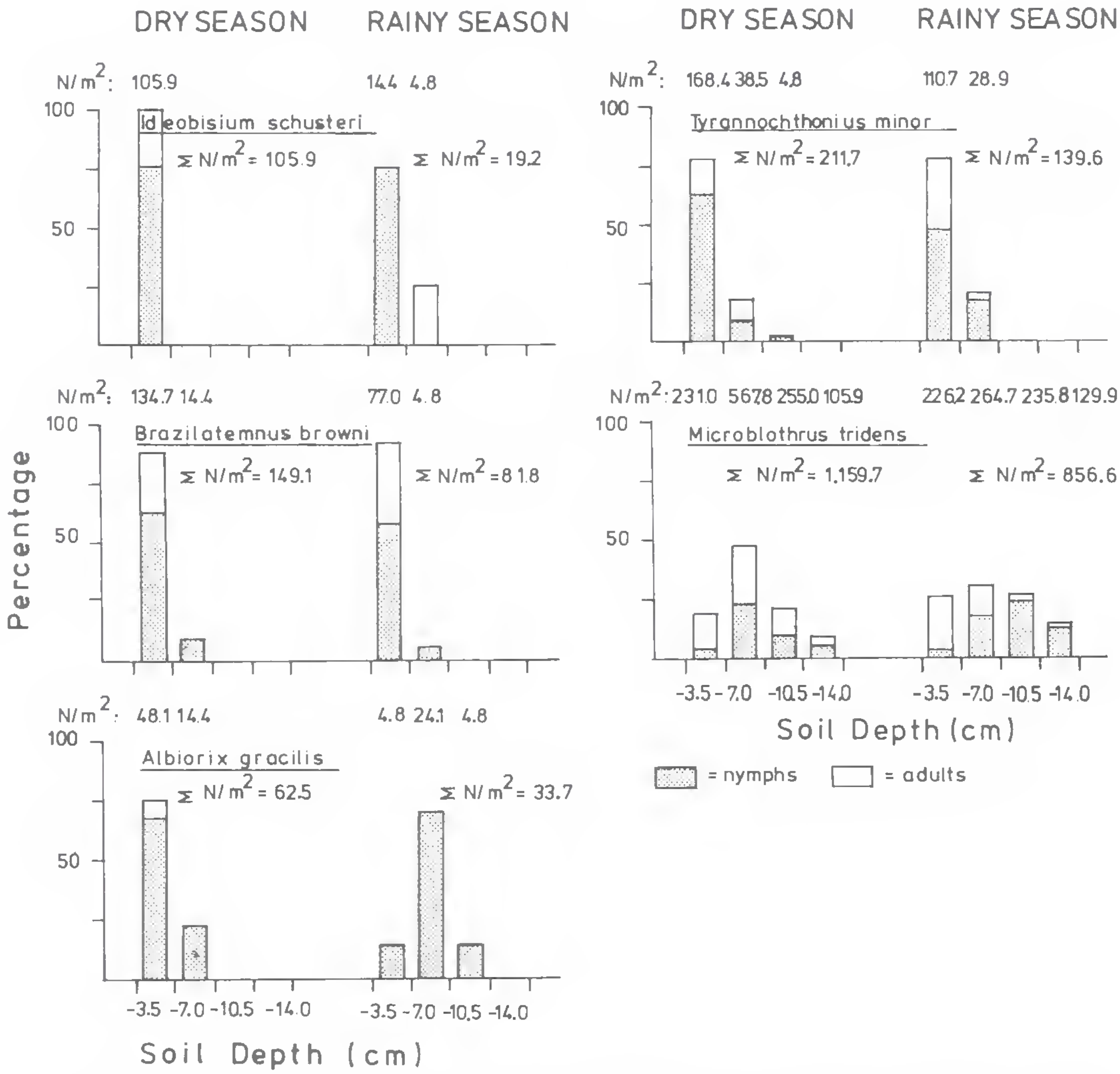

FIG. 3. Vertical distribution of five species of pseudoscorpions in soil (%). Samples taken every 3.5cm to depth of 14cm during dry season and rainy season in primary dryland forest on yellow latosol near Manaus, Brazil. Total catch each season = 100%. Abundance for each layer (N/m^2) and total catch per season (Σ N/m^2).

abundance was calculated for 1 m^2. Vertical distribution of adults and nymphs in relation to changing conditions of soil moisture content, temperature and pH was statistically evaluated with the linear correlation test (Cavalli-Sforza, 1972), using the original field data.

RESULTS

Primary Forest on Yellow Latosol

Pseudoscorpions accounted for 10-15% of all arthropods extracted from 1m^2 soil of 14cm depth (10,000-12,000 ind./m^2, Acari and Collembola disregarded) in the study area (Adis *et al.*, unpublished data). During the dry season, about 41% of all 1,700 (±71) pseudoscorpions were collected from the top 3.5.cm, 37% from below the humus layer (3.5-7cm) and 22% at 7-14cm depth. About 54% of all specimens collected represented juvenile stages (Fig. 1: nymphs). Decreasing abundance of pseudoscorpions at greater soil depths was significantly correlated with increasing soil moisture content (adults and nymphs: $P<0.01$, $r = -0.998$, nymphs only: $P<0.05$, $r = -0.956$; $n = 4$). During the rainy season, vertical distribution was similar (Fig. 1):

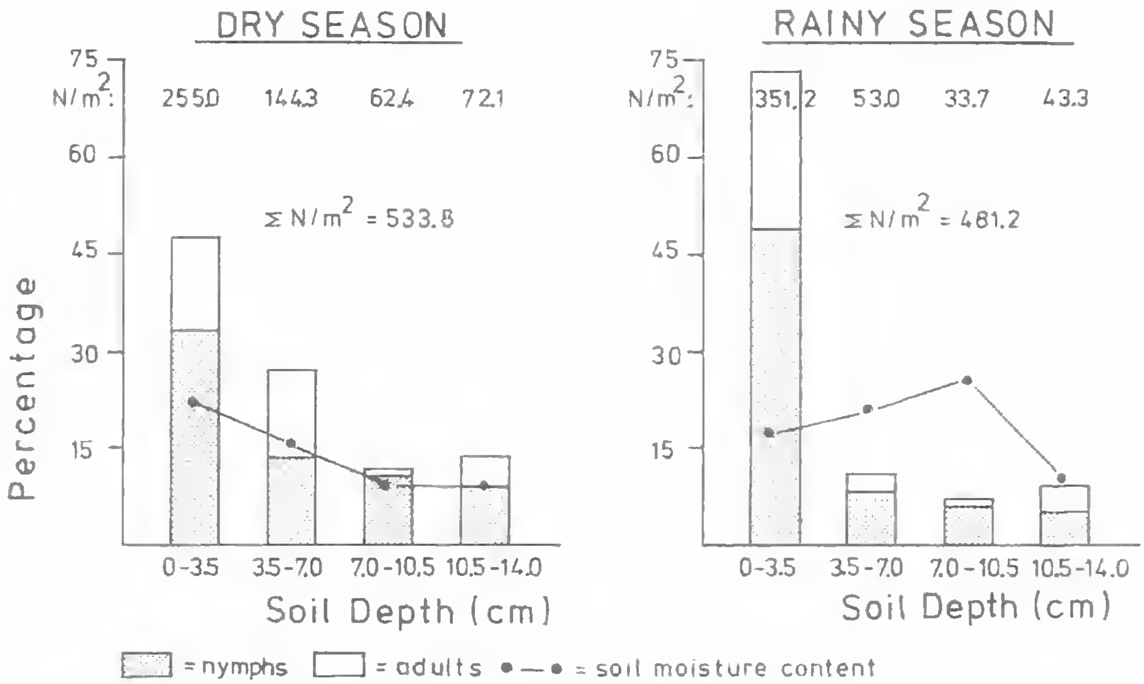

FIG. 4. Distribution of pseudoscorpions in soil and soil moisture content (both in %). Samples taken every 3.5cm to depth of 14cm during dry season and rainy season in primary dryland forest on white sand soil near Manaus, Brazil. Total catch each season = 100%. Abundance for each soil layer (N/m^2) and total catch / season ($\Sigma N/m^2$).

38% of the 1,100 ($\pm$46) pseudoscorpions were recovered from the top 3.5 cm, 29% from 3.5-7cm and 33% from 7-14cm soil depth. About 61% of the total catch were nymphs. Decreasing abundance of pseudoscorpions at greater soil depths was significantly correlated with decreasing soil temperature (adults and nymphs: $P<0.01$, $r = +0.993$, nymphs only: $P<0.05$, $r= +0.956$; $n = 4$).

Six species of pseudoscorpions were collected in both seasons (Fig. 2). All were previously reported from soils of Amazonian dryland forests (Mahnert and Adis, 1985). Syarinidae were most abundant, with *Microblothrus tridens* Mahnert (dry season: 1160 $\pm$ 55 ind./m^2, rainy season: 860 $\pm$ 24 ind./m^2), *Ideobisium schusteri* Mahnert and *Ideoblothrus tenuis* Mahnert accounting for 74-78% of the total catch (Fig. 2). Chthoniidae was the next most abundant family, with *Tyrannochthonius (T.) minor* Mahnert (= *Lagynochthonius minor* (Mahnert)); dry season: 212 $\pm$ 17.4 ind./m^2, rainy season: 140 $\pm$ 14 ind./m^2) and (dry season only) *Pseudochthonius homodentatus* Chamberlin representing 12-13% of the total catch. Less abundant (>10%) were Miratemnidae (*Brazilatemnus browni* Muchmore[1]; dry season: 149 $\pm$ 20 ind./m^2, rainy season: 82 $\pm$ 13 ind./m^2) and Ideoroncidae (*Albiorix gracilis* Mahnert). Few differences in dominance were found for species captured during both seasons, however their abundance varied (Fig. 2).

Except for *A. gracilis*, vertical distribution of pseudoscorpions in the soil differed between species but not within species when comparing different seasons (Fig. 3). *I. schusteri* and *B. browni* were only found at 0-7cm soil depth, with abundances being greatest in the top 3.5cm. This is also true for *T. minor* which lived, like *A. gracilis*, to a soil depth of 10.5cm. However, occurrence was restricted to the upper 7cm in *T. minor* during the rainy season and in *A. gracilis* during the dry season (Fig. 3). *I. tenuis* was found only at a soil depth of 3.5-7cm (= below the humus layer) during both seasons, whereas *M. tridens* occurred in all soil layers (0-14cm). During the dry season, significant correlation was observed between decreasing abundance of *T. minor* and greater soil depths (Fig. 3) and the

[1] At this locality, *B. browni* is apparently smaller. It may have adapted to its environment, thus representing an eco-species.

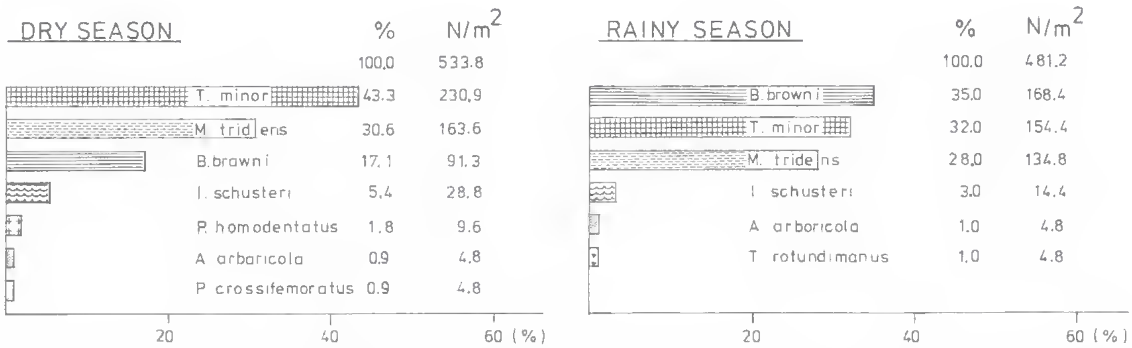

FIG. 5. Dominance (%) and abundance (N/m^2) of species of pseudo scorpions extracted from 1m^2 soil (0-14cm depth) during dry (August 1988) and rainy (March 1988) seasons in primary dryland forest on white sand soil near Manaus, Brazil. Total catch of each season = 100%. (See text for further explanation).

increased soil moisture content (P<0.05; adults and nymphs: r = -0.959, adults only: r = -0.968; P<0.10; r = -0.936 for nymphs only; n=4, respectively). Similar results were recorded from *A. gracilis* (P<0.05; adults and nymphs: r = -0.969, nymphs only: r = +0.974; n = 4). During the rainy season, decreasing abundance of *T. minor* and *B. browni* (Fig. 3) was significantly correlated with increasing pH values at greater soil depths (*T. minor*: P <0.05, r = -0.970 for adults and nymphs, r = -0.951 for nymphs only and P <0.01, r = -0.994 for adults only; *B. browni*: P<0.01, r = -0.998 for adults and nymphs and r = -0.995 for nymphs only; n = 4, respectively). In *M. tridens*, the increasing abundance of nymphs at greater soil depths was significantly correlated with decreasing soil moisture content (P<0.05, r = -0.977; n = 4). The decrease in abundance of adults, however, was significantly correlated with the decrease of the soil temperature at greater soil depths (P<0.05, r = +0.962; n = 4). This was also observed for nymphs of *T. minor* (P<0.05, r = +0.951; n = 4). Neoteny and potential parthenogenesis were confirmed for *M. tridens*, with sexually mature tritonymphs (= males) being absent (cf. Adis and Mahnert, 1990a; Mahnert, 1985).

Primary Forest on White Sand Soil

Pseudoscorpions accounted for 3-4% of all arthropods extracted from 1m^2 soil of 14cm depth (14,000-15,000 ind./m^2, Acari and Collembola disregarded) in the study area (Adis *et al.*, 1989a, b). During the dry season, about 48% of the total 530 (±22) pseudoscorpions were collected from the top 3.5cm, 27% from 3.5-7cm, 12% from 7-10.5cm (= humus layer) and 13% from the white sand soil layer (10.5-14cm). About 66% of all specimens collected represented juvenile stages (Fig. 4: nymphs). Decreasing abundance of pseudoscorpions at greater soil depths was significantly correlated with decreasing soil moisture content (P<0.05; adults and nymphs: r = +0.965, adults only: r = +0.952; n=4) and decreasing soil temperature (P<0.05; adults and nymphs: r = +0.967; n=4). During the rainy season, vertical distribution was similar but more pronounced (Fig. 4): 73% of the 480 (±27) pseudoscorpions were taken from the top 3.5cm, 11% from 3.5-7cm, 7% from 7-10.5cm and 9% from the white sand soil layer (10.5-14cm). About 68% of the total catch were nymphs. No significant correlation was found between the vertical distribution of pseudoscorpions and changing conditions of soil moisture content, soil temperature and pH.

Seven species of pseudoscorpions were obtained during the dry and six species during the rainy season (Fig. 5). All were previously reported from soils of Amazonian dryland forests (Mahnert and Adis, 1985). Chthoniidae were most abundant, with *Tyrannochthonius (T.) minor* Mahnert (dry season: 231±13 ind./m^2, rainy season: 154±15 ind./m^2), *T. (T.) rotundimanus* Mahnert and *Pseudochthonius homodentatus* Chamberlin accounting for 33-45% of the total catch (Fig. 5). Syarinidae was the next most abundant family with *Microblothrus tridens* Mahnert (dry season: 164±10 ind./m^2, rainy season: 135±8 ind./m^2) and *Ideobisium schusteri* Mahnert (dry season: 29±3 ind./m^2, rainy season 14±4 ind./m^2) accounting for 31-36% of the total catch. The Miratemnidae were represented by *Brazilatemnus browni* Muchmore (17-35%; dry season: 91±6 ind./m^2, rainy season: 168±16 ind./m^2). Less abundant (≤ 1%)

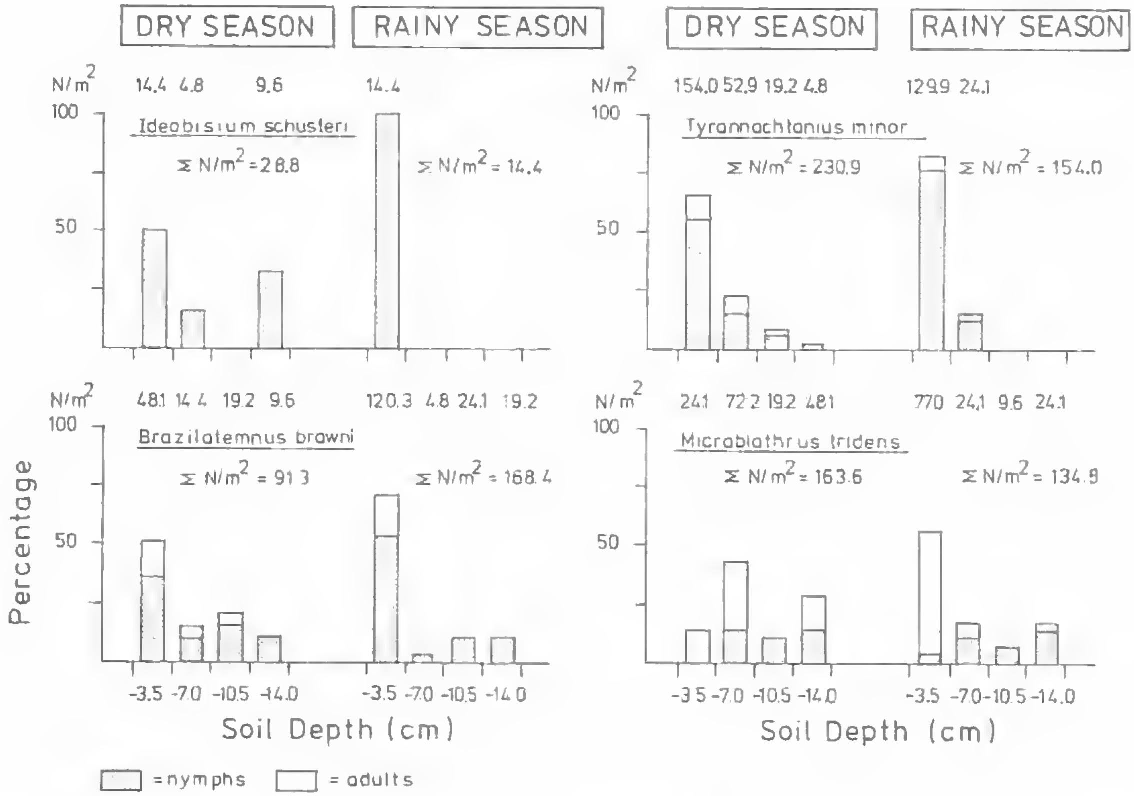

FIG. 6. Vertical distribution of four species of pseudoscorpions in soil (%). Samples taken every 3.5cm to depth of 14cm during dry and rainy seasons in primary dryland forest on white sand soil near Manaus, Brazil. Total catch of each season = 100%. Abundance given for each soil layer (N/m^2) and for total catch per season ($\Sigma N/m^2$).

were Ideoroncidae (*Albiorix gracilis* Mahnert) and Chernetidae (*Pseudopilanus crassifemoratus* Mahnert). The same four species (*T. minor*, *B. browni*, *M. tridens* and *I. schusteri*) were the most abundant in both seasons, however, their dominance in the total catch per season varied (Fig. 5). In two species, vertical distribution differed with the seasons. During the rainy season, *T. minor* and *I. schusteri* were found only from 0-7cm and in the top 3.5cm of soil, respectively. Both species were found throughout the 0-14cm soil sample during the dry season (Fig. 6). Their abundance was greatest in the top 3.5cm, independent of seasons. This is also true for *B. browni* which, together with *M. tridens*, occurred throughout the 0-14cm soil sample during the dry season as well as the rainy season. Adults of *M. tridens* were somewhat more abundant in the top 7cm, whereas no adults of *I. schusteri* were collected, probably due to low catch numbers. *A. arboricola* was restricted to the top 3.5cm. During the dry season, significant correlation between abundance and soil conditions was observed in *T. minor*: its abundance decreased at greater soil depths as the soil moisture content ($P<0.05$, $r = +0.979$ only for adults; $P<0.10$, $r = +0.935$ for adults and nymphs, $r = +0.900$ for nymphs only; $n = 4$, respectively) and the soil temperature decreased ($P<0.05$, $r = +0.967$ for adults and nymphs, $r = +0.972$ for adults; $P<0.10$, $r = +0.939$ for nymphs only; $n = 4$, respectively). No significant correlation was found during the rainy season between the vertical distribution of species and the abiotic factors investigated. In *M. tridens* sexually mature tritonymphs (= males) were absent, which confirms neoteny and potential parthenogenesis in this species (cf. 4.1.).

DISCUSSION

In Central Amazonia the abundance of pseudoscorpions in primary and secondary dryland forests on yellow latosol accounted (independently of seasons) for 3-5% of all arthropods extracted from $1m^2$ soil of 14cm depth and for 10-15% when Acari and Collembola were excluded (cf. Adis *et al.*, 1987a, b, unpublished data). In the primary forest on white sand soil, their abundance was only 0.7-0.9% and 3-4%, respectively, due to large numbers of Pauropoda and Diplura (cf. Adis *et al.*, 1989a, b). About two-thirds of all pseudoscorpions recovered from the soil of the primary and secondary forest on yellow latosol (61-67% of the total catch) and about three-quarters of the primary white sand forest (75-84%) inhabited the top 7cm. No species were found to occur exclusively in the lower, mineral subsoil (e.g. in 10.5-14cm soil depth). Two species (*T. minor*, *B. browni*) were more abundant in the upper, organic layer in the three forests which were investigated (Figs 3, 6; fig. 3 in Adis and Mahnert, 1990a). *M. tridens*, *T. minor* and *B. browni* were the most abundant species, representing 89-95% of the total catch in the primary forests on yellow latosol and on white sand soil. They represented 58-74% of the total catch in the secondary forest on yellow latosol, where *I. tenuis* and *A. gracilis* were frequent as well (22-33% of the total catch; cf. Adis and Mahnert, 1990a). The similar spectrum of pseudoscorpion species in forests on yellow latosol and on white sand soil and especially the lack of endemic species in the latter forest type, confirm the geological results of Chauvel *et al.* (1987). They reported that the white sand area investigated represents the final stage of podzolisation, i.e. the transformation of clayey latosols to white sandy podzols by (long-term) weathering and leaching processes. If the white sand area were a large dried-up old riverbed, species composition would be different from the yellow latosol area (cf. Adis and Mahnert, 1990b).

Neither during the dry nor the rainy season was the abundance of pseudoscorpions in mineral subsoils higher in response to the changing moisture content in organic layers. This phenomenon has been reported in arthropods in the seasonally-dry tropical forests, where periods without precipitation occur [cf. climate diagrams for Central America (Walter and Lieth, 1960-67) and for Manaus (Worbes, 1986)]. Higher or lower abundance of (at least some) species at a distinct soil depth seems to be related to different abiotic factors. For example, the decreasing abundance of *T. minor* with soil depth during the dry season was correlated with soil moisture content in two forest types: negatively with increasing moisture content values in the primary forest on yellow latosol and positively with decreasing soil moisture in the primary forest on white sand soil (cf. 4.1, 4.2.). In addition, decreasing abundance with depth was also related to somewhat lower temperatures recorded from the lower levels of soil in the white sand forest. During the rainy season, no correlation was found between species abundance and soil moisture content in these two forest types. However, in the forest on yellow latosol there was positive correlation between decreased abundance of nymphs and lower soil temperatures and negative correlation between decreased abundance of nymphs, nymphs and adults ($P<0.05$) and increased soil pH. At greater soil depths there was an even higher statistical probability ($P<0.01$) of negative correlation between decreased abundance of adults and increased pH. Correlation between abundance and soil moisture content has not yet been reported for *T. minor* from the secondary forest on yellow latosol (Adis and Mahnert, 1990a). The more homogeneous occurrence of *M. tridens* in 0-14cm soil depth (Figs 3, 6; fig. 3 in Adis and Mahnert, 1990a) was correlated with soil moisture content as well: there was positive correlation between decreasing numbers of nymphs and soil moisture in the primary forest on yellow latosol during the rainy season and, correspondingly, negative correlation between increasing abundance of nymphs and decreasing soil moisture content at greater soil depths in the secondary forest on yellow latosol (cf. Adis and Mahnert, 1990a). In adults, however, there was a positive correlation between decreased abundance and soil moisture content (secondary forest) and between decreased abundance and lower temperatures at greater soil depths (primary forest).

These data all suggest that factors other than soil moisture content (abiotic and/or biotic ones) may as well cause the different distribution of pseudoscorpion species in the soil. A significant correlation, for example, was found between the abundance of pseudoscorpions and Collembola in the secondary forest on yellow latosol ($P<0.05$; dry season: $r = +0.969$, rainy season: $r = +0.989$; $n = 4$) and in the primary forest on white sand soil (dry season: $P<0.01$, $r = +0.991$, rainy season: $P<0.05$, $r = +0.967$; $n = 4$). This relationship has to be investigated in more detail, as springtails represent a potential food source for pseudoscorpions (cf. Jones, 1975; Ressl and Beier, 1958; Weygoldt, 1969). Thus, complementary studies should be carried out on reproduction patterns, food availability and trophic structure over a one-year period (cf. Adis *et al.*, 1988). Data also show that the number of samples taken per soil layer (n= 6) was sufficient for a species dominance of 5% of the total catch, as standard deviation did not exceed 20%. Results indicate that terricole pseudoscorpions of primary dryland forests on white sand soil and of secondary dryland forests on yellow latosol represent the terricole species spectrum of a primary dryland forest on yellow latosol, which has been altered either by geomorphological/geochemical processes or human impact (cf. Morais, 1985; Rodrigues, 1986). Habitat preference in pseudoscorpions and the many habitat types existing in Amazonia are considered to be major reasons for the high species diversity found in neotropical pseudoscorpions (cf. Adis and Mahnert, 1985, 1990b).

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